Forest Survey Report No. 6
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Forest Statistics for

Chugach Working Circle

U.S. Department of Agriculture
Forest Service

CHUGACH WORKING CIRCLE

FOREST INVENTORY STATISTICS

CHUGACH NATIONAL FOREST

Forest Survey Report No. 6

Institute of Northern Forestry
and
Division of Timber Management
Region 10

Forest Service
U. S. Department of Agriculture
1967

CONTENTS

Forward 1

Map of Revised Block Boundaries 2

Map of Original Survey Unit Boundaries 3

Summary Tables

1. Area by land class, by management units, combined ownerships 4

2. Area of commercial forest land by ownership class and management unit 5

3. Net volume of live sawtimber on commercial forest land by ownership class and block 6

4. Area by land class, by management units 7

5. Net volume of live sawtimber on National Forest commercial forest land by operability class and block 8

6. Area of National Forest commercial forest land by stand-size class, block and operability class 9

7. Net volume of live sawtimber on National Forest commercial forest land by stand-size class, block and operability class 10

8. Area of National Forest commercial forest land by forest type and block 12

9. Net volume of live sawtimber on National Forest commercial forest land by species, block and operability class 13

10. Net volume of all timber on National Forest commercial forest land by class of material, species group and operability class 15

11. Net volume of live sawtimber on National Forest commercial forest land by species group and diameter class 20

12. Net volume of sawtimber on commercial forest land by selected species and log quality classes 21

13. Gross and net sawtimber volume and volume deducted for defect and breakage by species, in live merchantable trees 22

14. Area and volume inventory classification on National Forest commercial forest land by method of regulation of cut 23

15. Area and volume on National Forest commercial forest land by operability class, local type, stand-size class, working group, species and block 26

16. Average net volume per acre in live merchantable trees on commercial forest land by block, operability class, stand-size class and block 34

Explanation of Terms

Land-Use Classes 35

Forest Type 36

Stand-Size Class 37

Volume Estimates 39

Operability 40

Working Group 42

Sample Design 43

Reliability of the Estimates 46

Cull 49

FOREWORD

This is the sixth in a series of statistical reports on the forest areas and timber volumes of coastal Alaska prepared primarily for the benefit and use of the U. S. Forest Service, Region 10. Land areas and timber volumes within the exterior boundaries of the Chugach National Forest are summarized by blocks of planning purposes.

This survey was financed by Region 10 and the Forest Survey (a national program of the Forest Service). Vertical, panchromatic aerial photography taken at 1:15,840 scale from 1958 to 1961 was furnished by Region 10. The field work was accomplished between 1960 and 1962 with the major portion done before January 1, 1961.

The survey was designed to inventory the Chugach National Forest by four units. After the inventory was completed but before the report was written a new district was created on the Chugach. Therefore, the report was modified so that statistics reported conformed to the new blocks (districts). Included are two maps, one of which delineates the reporting areas and the second the inventory areas.

The appendix defines the terms used in the survey in relation to inventory units.

The Afognak block remains unchanged. The present Anchorage block includes parts of the initial Whittier block and Kenai Working Circle. The present Kenai block is the remainder of the Kenai Working Circle. The Cordova block is made up of the Copper River block and the remainder of the Whittier block.

No attempt has been made to adjust the statistics to a current date. The chief factors of change--growth, mortality, decay, cutting--are not known well enough or are not great enough to improve upon the statistics as shown. In general, it is believed that very little change is taking place in the old-growth stands. Because most of the volume was accounted for by field plots taken in 1960, January 1, 1961, can be used for the Working Circle totals.

The following persons contributed to this inventory:

Supervision and Planning - O. K. Hutchison, A. P. Caporaso

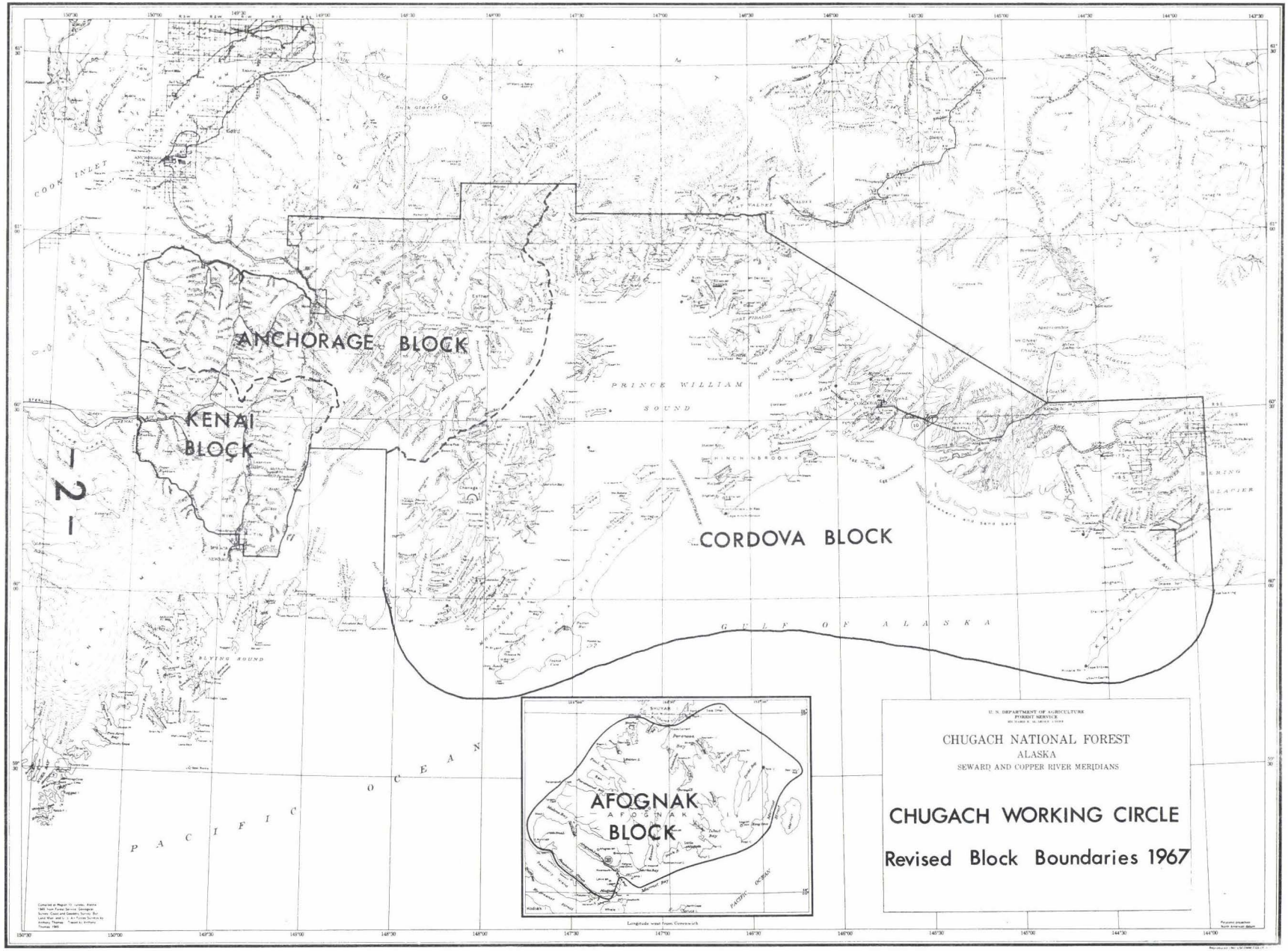
Statistical Procedures - F. A. Johnson, P. M. Haack

Photo Interpretation - T. H. Laurent, V. J. LaBau

Field Work - J. T. Bones, J. D. Born, W. A. Farr, P. M. Haack, K. M. Hegg, V. J. LaBau, T. H. Laurent, R. B. Mattson, G. Meier

Office Compilation and Report - R. B. Mattson

The assistance of J. E. Weisgerber, J. E. Brewer and others of Region 10 staff is gratefully acknowledged.


ANCHORAGE BLOCK
KENAI BLOCK
CORDOVA BLOCK
AFOGNAK BLOCK
AFOGNAK
PRINCE WILLIAM SOUND
GULF OF ALASKA
PACIFIC OCEAN
COOK INLET
KACHEMAK BAY
KODIAK
U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
CHUGACH NATIONAL FOREST
ALASKA
SEWARD AND COPPER RIVER MERIDIANS
CHUGACH WORKING CIRCLE
Revised Block Boundaries 1967

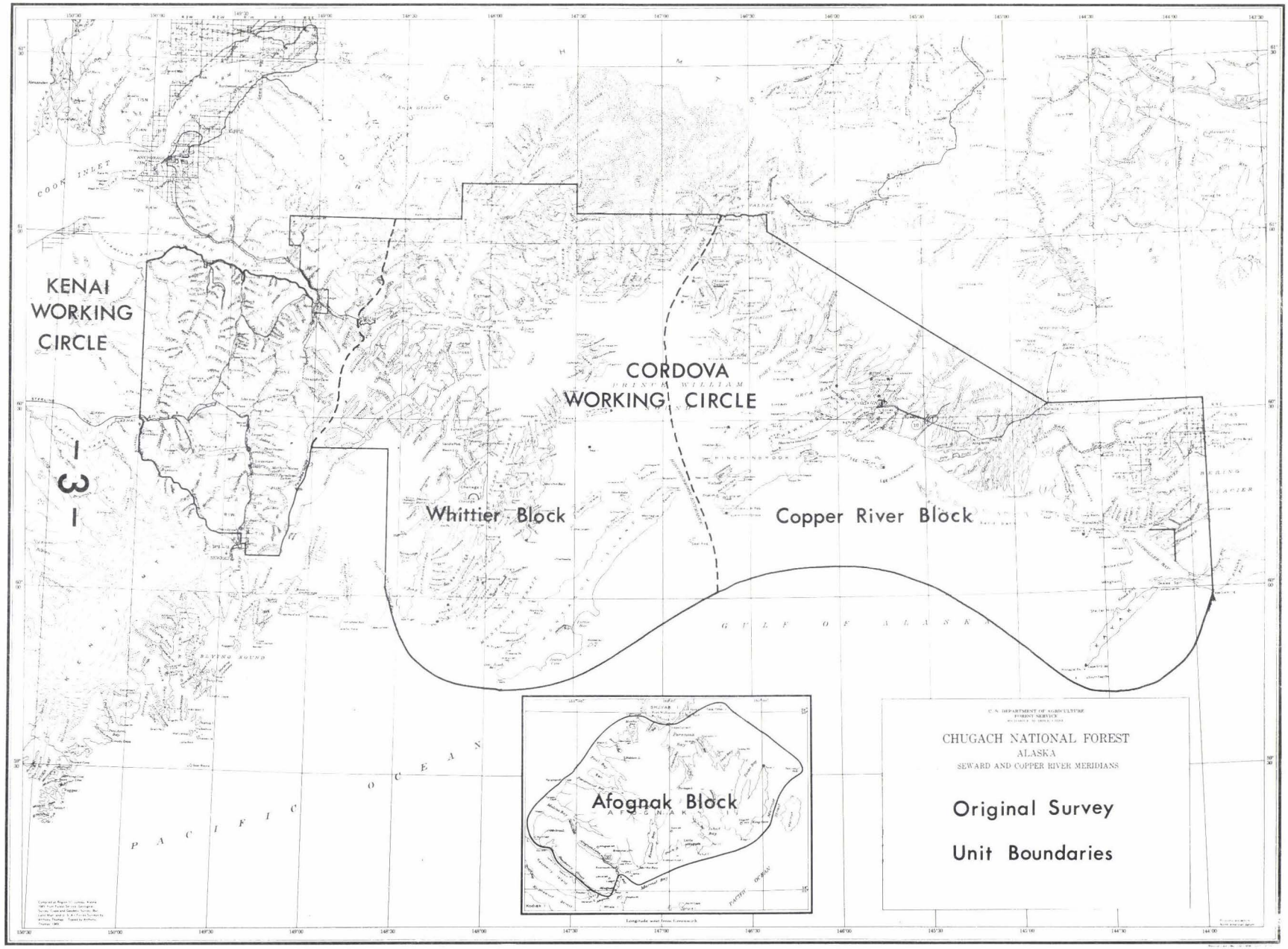

KENAI
WORKING
CIRCLE
CORDOVA
WORKING CIRCLE
Whittier Block
Copper River Block
Afognak Block
COOK INLET
PRINCE WILLIAM SOUND
GULF OF ALASKA
PACIFIC OCEAN
CHUGACH NATIONAL FOREST
ALASKA
SEWARD AND COPPER RIVER MERIDIANS
Original Survey
Unit Boundaries

Table 1.-- Area by land class, by management units, combined ownerships, Chugach National Forest - January 1, 1961

(Acres)

Block	Forest land				Non-Forest 1/	Total
	Commercial			Non-Commercial		
	Operable	Inoperable	Total			
Afognak	174,000	56,000	230,000	48,500	180,300	458,800
Anchorage	25,100	88,400	113,500	224,300	992,500	1,330,300
Cordova	98,700	202,500	301,200	653,400	1,366,600	2,321,200
Kenai	30,500	79,300	109,800	41,000	492,600	643,400
Total	328,300	426,200	754,500	967,200	3,032,000	4,753,700

1/ Includes 40,542 acres of water according to survey standards of classification but defined by the Bureau of the Census as land. These are water areas between 10 and 40 acres.

Table 2.--Area of commercial forest land by ownership class and management unit, Chugach National Forest - January 1, 1961

(Acres)

Block	Ownership class			Total
	National Forest	Other Federal	Other	
Afognak	229,200	800	0	230,000
Anchorage	112,500	0	1,000	113,500
Cordova	299,000	1,200	1,000	301,200
Kenai	107,800	0	2,000	109,800
Total	748,500	2,000	4,000	754,500

Table 3.--Net volume of live sawtimber on commercial forest land by ownership class and block, Chugach National Forest - January 1, 1961

(Million board feet)

Block	Ownership class			Total
	National Forest	Other Federal	Other	
	(Scribner rule)			
Afognak	5,253.6	23.0	0	5,276.6
Anchorage	1,356.0	0	9.4	1,365.4
Cordova	6,765.9	29.5	24.6	6,820.0
Kenai	923.9	0	21.6	945.5
Total	14,299.4	52.5	55.6	14,407.5

(Million board feet)

Block	Ownership class			Total
	National Forest	Other Federal	Other	
	(International 1/4-inch)			
Afognak	5,847.6	25.4	0	5,873.0
Anchorage	1,517.4	0	10.6	1,528.0
Cordova	7,419.7	32.3	27.0	7,479.0
Kenai	1,057.6	0	24.7	1,082.3
Total	15,842.3	57.7	62.3	15,962.3

Table 4.--Area by land class, by management units, Forest Service ownership, Chugach National Forest - January 1, 1961

(Acres)

Block	Forest land				Non-Forest	Total
	Commercial			Non-Commercial		
	Operable	Inoperable	Total			
Afognak	173,200	56,000	229,200	48,400	180,000	457,600
Anchorage	24,600	87,900	112,500	223,700	992,000	1,328,200
Cordova	97,900	201,100	299,000	648,200	1,350,100	2,297,300
Kenai	29,600	78,200	107,800	40,800	491,700	640,300
Total	325,300	423,200	748,500	961,100	3,013,800	4,723,400

Table 5.--Net volume of live sawtimber on National Forest commercial forest land by operability class and block, Chugach National Forest, January 1, 1961

(Million board feet)

Block	Commercial forest land		Total
	Operable	Inoperable	
	(Scribner rule)		
Afognak	4,561.7	691.9	5,253.6
Anchorage	442.3	913.7	1,356.0
Cordova	2,512.2	4,253.7	6,765.9
Kenai	420.8	503.1	923.9
Total	7,937.0	6,362.4	14,299.4

Block	Commercial forest land		Total
	Operable	Inoperable	
	(International 1/4 inch)		
Afognak	5,066.6	781.1	5,847.7
Anchorage	495.7	1,021.7	1,517.4
Cordova	2,752.8	4,666.9	7,419.7
Kenai	481.3	576.2	1,057.5
Total	8,796.4	7,045.9	15,842.3

Table 6.--Area of National Forest commercial forest land by stand-size class, block, and operability class,

Chugach National Forest - January 1, 1961

(Acres)

Block	Stand-size class						
	Old-Growth	Sawtimber					
	More than 8.0 MBF per acre	1.5-8.0 MBF per acre	Young-Growth Sawtimber	Poletimber	Seed-Saps	Nonstocked	Total
			Operable				
Afognak	126,700	0	46,500	0	0	0	173,200
Anchorage	21,500	1,200	1,900	0	0	0	24,600
Cordova	96,300	0	1,600	0	0	0	97,900
Kenai	25,200	1,700	2,700	0	0	0	29,600
Total	269,700	2,900	52,700	0	0	0	325,300
Afognak	3,700	0	25,800	25,200	900	400	56,000
Anchorage	40,000	16,000	5,100	7,100	19,600	100	87,900
Cordova	158,300	0	21,100	3,200	16,900	1,600	201,100
Kenai	24,100	25,700	2,500	11,700	13,700	500	78,200
Total	226,100	41,700	54,500	47,200	51,100	2,600	423,200

Table 7A.--Net volume of live sawtimber on National Forest commercial forest land by stand-size class, block, and operability class, Chugach National Forest - January 1, 1961

(Million board feet) (Scribner rule)

Block	Stand-size class: Old-Growth Sawtimber More than 8.0 MBF per acre	Old-Growth Sawtimber 1.5-8.0 MBF per acre	Young-Growth Sawtimber	Poletimber	Seed-Saps	Nonstocked	Total
			Operable				
Afognak	3,620.3	0	941.4	0	0	0	4,561.7
Anchorage	412.7	5.7	23.9	0	0	0	442.3
Cordova	2,502.2	0	10.0	0	0	0	2,512.2
Kenai	379.1	8.2	33.5	0	0	0	420.8
Total	6,914.3	13.9	1,008.8	0	0	0	7,937.0
			Inoperable				
Afognak	106.6	0	522.1	63.2	0	0	691.9
Anchorage	807.7	75.7	20.0	4.0	6.3	0	913.7
Cordova	4,115.4	0	94.6	17.1	26.6	0	4,253.7
Kenai	360.4	121.5	13.2	6.7	1.3	0	503.1
Total	5,390.1	197.2	649.9	91.0	34.2	0	6,362.4

Table 7B.--Net volume of live sawtimber on National Forest commercial forest land by stand-size class, block, and operability class, Chugach National Forest - January 1, 1961

(Million board feet) (International 1/4 inch)

Block	Stand-size class: Old-Growth Sawtimber More than 8.0 MBF per acre	Old-Growth Sawtimber 1.5-8.0 MBF per acre	Young-Growth Sawtimber	Poletimber	Seed-Saps	Nonstocked	Total
			Operable				
Afognak	4,002.8	0	1,063.8	0	0	0	5,066.6
Anchorage	461.7	6.5	27.5	0	0	0	495.7
Cordova	2,741.5	0	11.3	0	0	0	2,752.8
Kenai	433.2	9.5	38.6	0	0	0	481.3
Total	7,639.2	16.0	1,141.2	0	0	0	8,796.4
			Inoperable				
Afognak	117.8	0	590.0	73.2	0	0	781.0
Anchorage	899.8	87.0	23.0	4.7	7.2	0	1,021.7
Cordova	4,508.8	0	108.0	19.8	30.3	0	4,666.9
Kenai	412.0	139.8	15.2	7.8	1.5	0	576.3
Total	5,938.4	226.8	736.2	105.5	39.0	0	7,045.9

Table 8.--Area of National Forest commercial forest land by forest type and block, Chugach National Forest - January 1, 1961

(Acres)

Block	Forest Type			Total
	Hemlock-Sitka spruce	Sitka spruce	Hardwoods	
		Operable		
Afognak	0	173,200	0	173,200
Anchorage	23,900	0	700	24,600
Cordova	97,900	0	0	97,900
Kenai	28,200	0	1,400	29,600
Total	150,000	173,200	2,100	325,300
		Inoperable		
Afognak	0	56,000	0	56,000
Anchorage	70,700	0	17,200	87,900
Cordova	191,300	0	9,800	201,100
Kenai	62,900	0	15,300	78,200
Total	324,900	56,000	42,300	423,200

Table 9A.--Net volume of live sawtimber on National Forest commercial forest land by species, block, and operability class, Chugach National Forest - January 1, 1961

(Million board feet) (Scribner rule)

Block	Species						Total
	Western hemlock	Mountain hemlock	Sitka spruce	White spruce	Paper birch	Cottonwood	
				Operable			
Afognak	0	0	4,561.7	0	0	0	4,561.7
Anchorage	116.4	71.5	244.9	1.7	0.3	7.5	442.3
Cordova	1,360.8	0	1,151.4	0	0	0	2,512.2
Kenai	0	132.8	266.3	3.1	0.5	18.1	420.8
Total	1,477.2	204.3	6,224.3	4.8	0.8	25.6	7,937.0
				Inoperable			
Afognak	0	0	691.9	0	0	0	691.9
Anchorage	275.3	144.5	486.5	3.2	0.8	3.4	913.7
Cordova	2,283.8	0	1,958.2	0	0	11.7	4,253.7
Kenai	0	181.7	313.1	4.1	1.4	2.8	503.1
Total	2,559.1	326.2	3,449.7	7.3	2.2	17.9	6,362.4

Table 9B.--Net volume of live sawtimber on National Forest commercial forest land by species, block, and operability class, Chugach National Forest - January 1, 1961

(Million board feet) (International 1/4 inch)

Block	Species						Total
	Western hemlock	Mountain hemlock	Sitka spruce	White spruce	Paper birch	Cottonwood	
			Operable				
Afognak	0	0	5,066.6	0	0	0	5,066.6
Anchorage	128.9	82.3	273.5	2.0	0.3	8.7	495.7
Cordova	1,507.8	0	1,245.0	0	0	0	2,752.8
Kenai	0	152.8	303.7	3.5	0.5	20.8	481.3
Total	1,636.7	235.1	6,888.8	5.5	0.8	29.5	8,796.4
			Inoperable				
Afognak	0	0	781.0	0	0	0	781.0
Anchorage	305.3	166.3	541.6	3.7	1.0	3.8	1,021.7
Cordova	2,532.2	0	2,121.3	0	0	13.4	4,666.9
Kenai	0	209.2	357.6	4.7	1.5	3.3	576.3
Total	2,837.5	375.5	3,801.5	8.4	2.5	20.5	7,045.9

Table 10A.--Net volume of all timber on National Forest commercial forest land by class of material, species group and operability class, Chugach National Forest - January 1, 1961

Class of material	Grand Total	Total		Operable		Inoperable	
		Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
	(Million cubic feet)						
Growing stock:							
Sawtimber trees							
Sawlog portion	2,938.4	2,927.7	10.7	1,598.0	5.0	1,329.7	5.7
Upper-stem portion	107.0	105.3	1.7	58.6	0.8	46.7	0.9
Total	3,045.4	3,033.0	12.4	1,656.6	5.8	1,376.4	6.6
Poletimber trees	314.7	302.4	12.3	129.8	4.0	172.6	8.3
Total growing stock	3,360.1	3,335.4	24.7	1,786.4	9.8	1,549.0	14.9
Other material:							
Sound cull	23.5	23.2	0.3	11.4	0.1	11.8	0.2
Rotten cull	29.2	28.1	1.1	14.3	0.3	13.8	0.8
Salvable dead	19.7	19.7	0	8.2	0	11.5	0
Total	72.4	71.0	1.4	33.9	0.4	37.1	1.0
Total--All material	3,432.5	3,406.4	26.1	1,820.3	10.2	1,586.1	15.9

Table 10B.--Net volume of all timber on National Forest commercial forest land by class of material, species group and operability class, Afognak Block, Chugach National Forest - January 1, 1961

Class of material	Grand Total	Total		Operable		Inoperable	
		Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
	(Million cubic feet)						
Growing stock:							
Sawtimber trees							
Sawlog portion	1,035.3	1,035.3	0	891.1	0	144.2	0
Upper-stem portion	39.6	39.6	0	34.1	0	5.5	0
Total	1,074.9	1,074.9	0	925.2	0	149.7	0
Poletimber trees	107.5	107.5	0	69.2	0	38.3	0
Total growing stock	1,182.4	1,182.4	0	994.4	0	188.0	0
Other material:							
Sound cull	7.1	7.1	0	5.5	0	1.6	0
Rotten cull	7.4	7.4	0	6.8	0	0.6	0
Salvable dead	1.5	1.5	0	1.5	0	0	0
Total	16.0	16.0	0	13.8	0	2.2	0
Total--All material	1,198.4	1,198.4	0	1,008.2	0	190.2	0

Table 10C.--Net volume of all timber on National Forest commercial forest land by class of material, species group and operability class, Anchorage Block, Chugach National Forest - January 1, 1961

Class of material	Grand Total	Total		Operable		Inoperable	
		Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
	(Million cubic feet)						
Growing stock:							
Sawtimber trees							
Sawlog portion	305.2	302.4	2.8	102.9	1.3	199.5	1.5
Upper-stem portion	11.8	11.4	0.4	3.9	0.2	7.5	0.2
Total	317.0	313.8	3.2	106.8	1.5	207.0	1.7
Poletimber	43.0	38.5	4.5	11.1	1.9	27.4	2.6
Total growing stock	360.0	352.3	7.7	117.9	3.4	234.4	4.3
Other material:							
Sound cull	2.8	2.7	0.1	0.8	0	1.9	0.1
Rotten cull	3.3	3.0	0.3	0.9	0.1	2.1	0.2
Salvable dead	3.3	3.3	0	1.1	0	2.2	0
Total	9.4	9.0	0.4	2.8	0.1	6.2	0.3
Total--All material	369.4	361.3	8.1	120.7	3.5	240.6	4.6

Table 10D.--Net volume of all timber on National Forest commercial forest land by class of material, species group and operability class, Cordova Block, Chugach National Forest - January 1, 1961

Class of material	Grand Total	Total		Operable		Inoperable	
		Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
	(Million cubic feet)						
Growing stock:							
Sawtimber trees							
Sawlog portion	1,379.9	1,376.8	3.1	510.8	0	866.0	3.1
Upper-stem portion	47.5	47.0	0.5	17.4	0	29.6	0.5
Total	1,427.4	1,423.8	3.6	528.2	0	895.6	3.6
Poletimber trees	122.2	119.0	3.2	38.2	0	80.8	3.2
Total growing stock	1,549.6	1,542.8	6.8	566.4	0	976.4	6.8
Other material:							
Sound cull	11.2	11.2	0	4.1	0	7.1	0
Rotten cull	16.0	15.7	0.3	5.8	0	9.9	0.3
Salvable dead	11.7	11.7	0	4.4	0	7.3	0
Total	38.9	38.6	0.3	14.3	0	24.3	0.3
Total--All material	1,588.5	1,581.4	7.1	580.7	0	1,000.7	7.1

Table 10E.--Net volume of all timber on National Forest commercial forest land by class of material, species group and operability class, Kenai Block, Chugach National Forest -January 1, 1961

Class of material	Grand Total	Total		Operable		Inoperable	
		Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
	(Million cubic feet)						
Growing stock:							
Sawtimber trees							
Sawlog portion	218.0	213.2	4.8	93.2	3.7	120.0	1.1
Upper-stem portion	8.1	7.3	.8	3.2	0.6	4.1	0.2
Total	226.1	220.5	5.6	96.4	4.3	124.1	1.3
Poletimber trees	42.0	37.4	4.6	11.3	2.1	26.1	2.5
Total growing stock	268.1	257.9	10.2	107.7	6.4	150.2	3.8
Other material:							
Sound cull	2.4	2.2	0.2	1.0	0.1	1.2	0.1
Rotten cull	2.5	2.0	0.5	0.8	0.2	1.2	0.3
Salvable dead	3.2	3.2	0	1.2	0	2.0	0
Total	8.1	7.4	0.7	3.0	0.3	4.4	0.4
Total--All material	276.2	265.3	10.9	110.7	6.7	154.6	4.2

Table 11.--Net volume of live sawtimber on National Forest commercial forest land by species and diameter class, Chugach National Forest, January 1, 1961

Species	All classes	Diameter class (inches d.b.h.) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-30.9	31.0-40.9	41.0 and larger
					Scribner (million board feet)					
Softwood:										
Western hemlock	4,036.3	0	187.4	243.3	310.4	426.0	375.7	1,726.8	679.9	86.8
Mountain hemlock	530.5	82.8	120.2	96.7	68.7	52.6	44.4	65.1	0	0
Sitka spruce	9,674.0	76.7	519.5	591.3	753.5	855.6	892.4	3,457.4	1,914.2	613.4
White spruce	12.1	2.3	1.0	3.0	2.6	1.5	0.5	1.2	0	0
Total softwood	14,252.9	161.8	828.1	934.3	1,135.2	1,335.7	1,313.0	5,250.5	2,594.1	700.2
Hardwood:										
Birch	3.0	0	1.7	0.8	0.3	0	0.2	0	0	0
Cottonwood	43.5	0	7.2	7.8	7.9	3.5	3.2	10.0	3.9	0
Total hardwood	46.5	0	8.9	8.6	8.2	3.5	3.4	10.0	3.9	0
All species	14,299.4	161.8	837.0	942.9	1,143.4	1,339.2	1,316.4	5,260.5	2,598.0	700.2

Table 12.--Net volume of sawtimber on commercial forest land by selected species and log quality classes, all ownerships, Chugach National Forest, January 1, 1961

Species	Total	Log quality classes				
		Selects	Peelers	No. 1	No. 2	No. 3
		Scribner (million board feet)				
Western hemlock	4,066	0	110	164	1,267	2,525
Mountain hemlock	540	0	--	--	117	423
Sitka spruce	9,741	--	0	298	2,912	6,531
Total	14,347	--	110	462	4,296	9,479
Percent	100.00	--	0.77	3.22	29.94	66.07

Table 13.--Gross and net sawtimber volume, and volume deducted for defect and breakage, by species, in live merchantable trees, all ownerships, Chugach National Forest, January 1, 1961

Species	Gross volume	Defect volume	Breakage volume	Net volume
	Scribner (million board feet)			
Western hemlock	5,350.6	1,117.4	166.7	4,066.5
Mountain hemlock	650.0	82.7	27.3	540.0
Sitka spruce	10,769.9	785.8	243.6	9,740.5
White spruce	15.8	3.2	0.4	12.2
Paper birch	4.3	1.2	0.1	3.0
Cottonwood	56.7	9.1	2.3	45.3
Total	16,847.3	1,999.4	440.4	14,407.5
Percent	100.0	11.9	2.6	85.5

Table 14A--Area and volume inventory classification on commercial forest land, Forest Service ownership by method of regulation of cut, Chugach National Forest - January 1, 1961

Nonmodified 1/

Block	Area by Type (Acres)			Volume					
				Scribner MMBF			Cubic Feed Growing Stock MMCF		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
Afognak	158,860	158,860	0	4,189.0	4,189.0	0	912.7	912.7	0
Anchorage	18,370	17,950	420	352.0	347.2	4.8	97.0	94.8	2.2
Cordova	96.050	96.050	0	2,468.2	2,468.2	0	556.3	556.3	0
Kenai	18,750	18,030	720	266.9	257.7	9.2	72.4	69.0	3.4
Total	292,030	290,890	1,140	7,276.1	7,262.1	14.0	1,638.4	1,632.8	5.6

1/ Includes Working Group I, Operable

Table 14B.--Area and volume inventory classification on commercial forest land, Forest Service Ownership by method of regulation of cut, Chugach National Forest - January 1, 1961

Modified [1/]

Block	Area by Type (Acres)			Volume					
				Scribner MMBF			Cubic Feet Growing Stock MMCF		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
Afognak	2,400	2,400	0	58.9	58.9	0	13.3	13.3	0
Anchorage	3,530	3,360	170	50.5	48.8	1.7	13.6	12.8	0.8
Cordova	1,600	1,600	0	41.6	41.6	0	9.3	9.3	0
Kenai	9,630	8,950	680	135.1	126.0	9.1	36.8	33.9	2.9
Total	17,160	16,310	850	286.1	275.3	10.8	73.0	69.3	3.7

[1/] Includes Working Group II, Operable

Table 14C.--Area and volume inventory classification on commercial forest land, Forest Service ownership by method of regulation of cut, Chugach National Forest - January 1, 1961

Unregulated 1/

Block	Area by Type (Acres)			Volume					
				Scribner MMBF			Cubic Feet Growing Stock MMCF		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
Afognak	67,940	67,940	0	1,005.8	1,005.8	0	256.4	256.4	0
Anchorage	90,600	75,220	15,380	953.5	948.4	5.1	249.5	244.7	4.8
Cordova	201,350	191,560	9,790	4,256.0	4,244.4	11.6	983.9	977.1	6.8
Kenai	79,470	64,150	15,320	521.9	517.4	4.5	158.9	155.1	3.8
Total	439,360	398,870	40,490	6,737.2	6,716.0	21.2	1,648.7	1,633.3	15.4

1/ Includes Working Group III, Operable
Working Group I, Inoperable
Working Group II, Inoperable
Working Group III, Inoperable

Table 15A.--Area and Scribner volume, Forest Service ownership by operability, local type, stand-size class, working group, and species, Chugach National Forest, January 1, 1961, Afognak Block, operable

Local type	Working group	Area (acres)	Scribner volume (million board feet)						
			Total	Western hemlock	Mountain hemlock	Sitka spruce	White spruce	Birch	Cottonwood
			Young-growth sawtimber						
Spruce	I	42,040	851.5	0	0	851.5	0	0	0
Spruce	II	1,160	23.5	0	0	23.5	0	0	0
Spruce	III	3,280	66.4	0	0	66.4	0	0	0
Total		46,480	941.4	0	0	941.4	0	0	0
			Old-growth sawtimber, more than 8.0 MBF per acre						
Spruce	I	116,820	3,337.5	0	0	3,337.5	0	0	0
Spruce	II	1,240	35.4	0	0	35.4	0	0	0
Spruce	III	8,660	247.4	0	0	247.4	0	0	0
Total		126,720	3,620.3	0	0	3,620.3	0	0	0
Grand Total		173,200	4,561.7	0	0	4,561.7	0	0	0

Table 15B.--Area and Scribner volume, Forest Service ownership by operability, local type, stand-size class, working group, and species, Chugach National Forest, January 1, 1961, Afognak Block, inoperable

Local type	Working group	Area (acres)	Scribner volume (million board feet)						
			Total	Western hemlock	Mountain hemlock	Sitka spruce	White spruce	Birch	Cottonwood
			Seedling-saplings						
Spruce	I,II,III	850	0	0	0	0	0	0	0
Total		850	0	0	0	0	0	0	0
			Poles						
Spruce	I,II,III	25,210	63.2	0	0	63.2	0	0	0
Total		25,210	63.2	0	0	63.2	0	0	0
			Young-growth sawtimber						
Spruce	I	23,080	467.5	0	0	467.5	0	0	0
Spruce	II	750	15.2	0	0	15.2	0	0	0
Spruce	III	1,950	39.5	0	0	39.5	0	0	0
Total		25,780	522.2	0	0	522.2	0	0	0
			Old-growth sawtimber, more than 8.0 MBF per acre						
Spruce	I	3,460	98.8	0	0	98.8	0	0	0
Spruce	II	0	0	0	0	0	0	0	0
Spruce	III	270	7.7	0	0	7.7	0	0	0
Total		3,730	106.5	0	0	106.5	0	0	0
			Nonstocked						
Spruce	I,II,III	430	0	0	0	0	0	0	0
Total		430	0	0	0	0	0	0	0
Grand Total		56,000	691.9	0	0	691.9	0	0	0

Table 15C.--Area and Scribner volume, commercial forest land, Forest Service ownership by local type, stand-size class, working group, and species, Chugach National Forest, January 1, 1961

Anchorage Block, operable

Local type	Working group	Area (acres)	Scribner volume (million board feet)						
			Total	Western hemlock	Mountain hemlock	Sitka spruce	White spruce	Birch	Cottonwood
			Young-growth sawtimber						
Spruce-Hemlock	I	850	12.5	0	0	11.1	0	0.1	1.3
Spruce-Hemlock	II	260	3.7	0	0	3.3	0	0	0.4
Spruce-Hemlock	III	170	2.4	0	0	2.2	0	0	0.2
Cottonwood	I	420	3.6	0	0	0.3	0	0	3.3
Cottonwood	II	120	1.0	0	0	0.1	0	0	0.9
Cottonwood	III	80	0.7	0	0	0.1	0	0	0.6
Total		1,900	23.9	0	0	17.1	0	0.1	6.7
			Old-growth sawtimber, more than 8.0 MBF per acre						
Spruce-Hemlock	I	16,300	332.1	112.9	43.4	174.5	1.0	0.2	0.1
Spruce-Hemlock	II	2,850	43.7	1.4	14.4	27.5	0.4	0	0
Spruce-Hemlock	III	2,300	36.1	2.1	11.3	22.4	0.3	0	0
Cottonwood	II	50	0.8	0	0	0.1	0	0	0.7
Total		21,500	412.7	116.4	69.1	224.5	1.7	0.2	0.8
			Old-growth sawtimber, 1.5-8.0 MBF per acre						
Spruce-Hemlock	I	800	3.8	0	1.6	2.2	0	0	0
Spruce-Hemlock	II	250	1.2	0	0.5	0.7	0	0	0
Spruce-Hemlock	III	150	0.7	0	0.3	0.4	0	0	0
Total		1,200	5.7	0	2.4	3.3	0	0	0
Grand Total		24,600	442.3	116.4	71.5	244.9	1.7	0.3	7.5

Table 15D.--Area and Scribner volume, commercial forest land, Forest Service ownership by local type, stand-size class, working group, and species, Chugach National Forest, January 1, 1961, Anchorage Block, inoperable

Local type	Working group	Area (acres)	Scribner volume (million board feet)						
			Total	Western hemlock	Mountain hemlock	Sitka spruce	White spruce	Birch	Cottonwood
					Seedling-saplings				
Spruce-hemlock	I,II,III	7,920	6.3	3.8	0	2.5	0	0	0
Birch	I,II,III	5,570	0	0	0	0	0	0	0
Cottonwood	I,II,III	6,060	0	0	0	0	0	0	0
Total		19,550	6.3	3.8	0	2.5	0	0	0
					Poles				
Spruce-hemlock	I,II,III	3,510	3.3	0	2.1	1.2	0	0	0
Birch	I,II,III	2,950	0.5	0	0	0	0	0.5	0
Cottonwood	I,II,III	670	0.2	0	0	0.1	0	0	0.1
Total		7,130	4.0	0	2.1	1.3	0	0.5	0.1
					Young-growth sawtimber				
Spruce-hemlock	I	2,760	16.1	3.9	0.1	10.9	0.3	0.1	0.8
Spruce-hemlock	II	230	1.3	0.1	0.1	0.8	0.1	0	0.2
Spruce-hemlock	III	150	0.8	0.1	0	0.6	0	0	0.1
Cottonwood	I	1,850	1.8	0	0	0	0	0	1.8
Cottonwood	II	30	0	0	0	0	0	0	0
Cottonwood	III	50	0	0	0	0	0	0	0
Total		5,070	20.0	4.1	0.2	12.3	0.4	0.1	2.9
					Old-growth sawtimber, more than 8.0 MBF per acre				
Spruce-hemlock	I	29,300	640.3	258.0	57.6	323.2	1.2	0.1	0.2
Spruce-hemlock	II	4,800	74.5	3.5	23.8	46.5	0.6	0	0.1
Spruce-hemlock	III	5,900	92.9	5.9	28.7	57.4	0.7	0.1	0.1
Total		40,000	807.7	267.4	110.1	427.1	2.5	0.2	0.4
					Old-growth sawtimber, 1.5-8.0 MBF per acre				
Spruce-hemlock	I	8,500	40.2	0	17.1	23.0	0.1	0	0
Spruce-hemlock	II	2,700	12.8	0	5.4	7.3	0.1	0	0
Spruce-hemlock	III	4,800	22.7	0	9.6	13.0	0.1	0	0
Total		16,000	75.7	0	32.1	43.3	0.3	0	0
					Nonstocked				
Spruce-hemlock	I,II,III	150	0	0	0	0	0	0	0
Grand Total		87,900	913.7	275.3	144.5	486.5	3.2	0.8	3.4

Table 15E.--Area and Scribner volume, Forest Service ownership by operability, local type, stand-size class, working group, and species, Chugach National Forest, January 1, 1961, Cordova Block, operable

Local type	Working group	Area (acres)	Scribner volume (million board feet)						
			Total	Western hemlock	Mountain hemlock	Sitka spruce	White spruce	Birch	Cottonwood
			Young-growth sawtimber						
Spruce	I	1,450	8.8	2.9	0	5.9	0	0	0
Spruce	II	0	0	0	0	0	0	0	0
Spruce	III	180	1.2	0.5	0	0.7	0	0	0
Total		1,630	10.0	3.4	0	6.6	0	0	0
			Old-growth sawtimber, more than 8.0 MBF per acre						
Spruce	I	94,600	2,459.3	1,334.1	0	1,125.2	0	0	0
Spruce	II	1,600	41.6	22.6	0	19.0	0	0	0
Spruce	III	50	1.3	0.7	0	0.6	0	0	0
Total		96,250	2,502.2	1,357.4	0	1,144.8	0	0	0
Grand Total		97,880	2,512.2	1,360.8	0	1,151.4	0	0	0

Table 15F.--Area and Scribner volume, commercial forest land, Forest Service ownership by operability, local type, stand-size class, working group, and species, Chugach National Forest, January 1, 1961, Cordova Block, inoperable

Local type	Working group	Area (acres)	Scribner volume (million board feet)						
			Total	Western hemlock	Mountain hemlock	Sitka spruce	White spruce	Birch	Cottonwood
					Seedling-saplings				
Spruce-	I,II,III	13,750	26.6	21.9	0	4.7	0	0	0
Cottonwood	I,II,III	3,130	0	0	0	0	0	0	0
Total		16,880	26.6	21.9	0	4.7	0	0	0
					Poles				
Spruce	I,II,III	3,230	17.1	0	0	11.9	0	0	5.2
Total		3,230	17.1	0	0	11.9	0	0	5.2
					Young-growth sawtimber				
Spruce-hemlock	I	13,930	84.9	28.1	0	56.8	0	0	0
Spruce	II	80	0.5	0.2	0	0.3	0	0	0
Spruce	III	440	2.7	0.9	0	1.8	0	0	0
Cottonwood	I	6,570	6.4	0	0	0	0	0	6.4
Cottonwood	II	90	0.1	0	0	0	0	0	0.1
Cottonwood	III	0	0	0	0	0	0	0	0
Total		21,110	94.6	29.2	0	58.9	0	0	6.5
					Old-growth sawtimber, more than 8.0 MBF per acre				
Spruce	I	156,000	4,055.6	2,200.3	0	1,855.3	0	0	0
Spruce	II	1,900	49.4	26.8	0	22.6	0	0	0
Spruce	III	400	10.4	5.6	0	4.8	0	0	0
Total		158,300	4,115.4	2,232.7	0	1,882.7	0	0	0
					Nonstocked				
Spruce	I,II,III	1,600	0	0	0	0	0	0	0
Total		1,600	0	0	0	0	0	0	0
Grand Total		201,120	4,253.7	2,283.8	0	1,958.2	0	0	11.7

Table 15G.--Area and Scribner volume, Forest Service ownership by operability, local type, stand-size class, working group, and species, Chugach National Forest, January 1, 1961, Kenai Block, operable

Local type	Working group	Area (acres)	Scribner volume (million board feet)						
			Total	Western hemlock	Mountain hemlock	Sitka spruce	White spruce	Birch	Cottonwood
			Young-growth sawtimber						
Spruce	I	1,030	14.6	0	0	13.0	0	0.1	1.5
Spruce	II	750	10.7	0	0	9.5	0	0.1	1.1
Spruce	III	30	0.4	0	0	0.4	0	0	0
Cottonwood	I	520	4.4	0	0	0.4	0	0	4.0
Cottonwood	II	380	3.2	0	0	0.3	0	0	2.9
Cottonwood	III	20	0.2	0	0	0	0	0	0.2
Total		2,730	33.5	0	0	23.6	0	0.2	9.7
			Old-growth sawtimber, more than 8.0 MBF per acre						
Spruce	I	16,000	239.4	0	83.7	153.2	2.1	0.2	0.2
Spruce	II	7,500	112.2	0	39.3	71.7	0.9	0.1	0.2
Spruce	III	1,200	17.9	0	6.3	11.5	0.1	0	0
Cottonwood	I	200	3.8	0	0	0.6	0	0	3.2
Cottonwood	II	300	5.8	0	0	1.0	0	0	4.8
Cottonwood	III	0	0	0	0	0	0	0	0
Total		25,200	379.1	0	129.3	238.0	3.1	0.3	8.4
			Old-growth sawtimber, 1.5-8.0 MBF per acre						
Spruce	I	1,000	4.7	0	2.0	2.7	0	0	0
Spruce	II	700	3.3	0	1.4	1.9	0	0	0
Spruce	III	40	0.2	0	0.1	0.1	0	0	0
Total		1,740	8.2	0	3.5	4.7	0	0	0
Grand total		29,670	420.8	0	132.8	266.3	3.1	0.5	18.1

Table 15H.--Area and Scribner volume, Forest Service ownership by operability, local type, stand-size class, working group, and species, Chugach National Forest, January 1, 1961, Kenai Block, inoperable

Local type	Working group	Area (acres)	Scribner volume (million board feet)						
			Total	Western hemlock	Mountain hemlock	Sitka spruce	White spruce	Birch	Cottonwood
					Seedling-saplings				
Spruce	I,II,III	4,160	1.3	0	0	1.3	0	0	0
Birch	I,II,III	4,160	0	0	0	0	0	0	0
Cottonwood	I,II,III	5,330	0	0	0	0	0	0	0
Total		13,650	1.3	0	0	1.3	0	0	0
					Poles				
Spruce	I,II,III	5,870	5.6	0	3.4	2.2	0	0	0
Birch	I,II,III	4,900	0.8	0	0	0	0	0.8	0
Cottonwood	I,II,III	910	0.3	0	0	0.1	0	0	0.2
Total		11,680	6.7	0	3.4	2.3	0	0.8	0.2
					Young-growth sawtimber				
Spruce	I	1,850	9.7	0	0.5	6.8	0.5	0.2	1.7
Spruce	II	600	3.2	0	0.1	2.2	0.2	0.1	0.6
Spruce	III	50	0.3	0	0	0.2	0	0	0.1
Total		2,500	13.2	0	0.6	9.2	0.7	0.3	2.4
					Old-growth sawtimber, more than 8.0 MBF per acre				
Spruce	I	13,000	194.4	0	68.1	124.5	1.5	0.2	0.1
Spruce	II	8,500	127.1	0	44.5	81.3	1.1	0.1	0.1
Spruce	III	2,600	38.9	0	13.6	24.9	0.4	0	0
Total		24,100	360.4	0	126.2	230.7	3.0	0.3	0.2
					Old-growth sawtimber, 1.5-8.0 MBF per acre				
Spruce	I	13,000	61.4	0	26.0	35.2	0.2	0	0
Spruce	II	10,000	47.3	0	20.1	27.1	0.1	0	0
Spruce	III	2,700	12.8	0	5.4	7.3	0.1	0	0
Total		25,700	121.5	0	51.5	69.6	0.4	0	0
					Nonstocked				
Spruce	I,II,III	500	0	0	0	0	0	0	0
Grand Total		78,130	503.1	0	181.7	313.1	4.1	1.4	2.8

Table 16.--Average net volume per acre in live merchantable trees on commercial forest land by blocks, operability class, and stand-size class, Chugach National Forest, January 1, 1961

Block	Stand-size class					
	Old-growth sawtimber		Young-growth sawtimber	Poletimber	Seedling-saplings	Non-stocked
	More than 8.0 MBF per acre	1.5-8.0 MBF per acre				
Afognak						
Operable	28,574	0	20,245	0	0	0
Inoperable	28,811	0	20,236	2,508	0	0
Unit average	28,581	0	20,242	2,508	0	0
Anchorage						
Operable	19,195	4,750	12,579	0	0	0
Inoperable	20,193	4,731	3,922	563	3,214	0
Unit average	19,844	4,733	6,271	563	3,214	0
Cordova						
Operable	25,983	0	6,250	0	0	0
Inoperable	25,997	0	4,484	5,344	1,574	0
Unit average	25,992	0	4,608	5,344	1,574	0
Kenai						
Operable	15,044	4,824	12,407	0	0	0
Inoperable	14,954	4,728	5,280	573	95	0
Unit average	15,000	4,734	8,981	573	95	0
Chugach						
Operable	25,637	4,793	19,142	0	0	0
Inoperable	23,839	4,729	11,925	1,928	669	0
Unit average	24,817	4,733	15,473	1,928	669	0

APPENDIX

EXPLANATION OF TERMS

This appendix defines the terms used here in relation to the old survey inventory blocks. See the Foreword and maps for a general explanation how the blocks changed from the inventory to the report.

Land-Use Classes

Forest land.--Includes (a) lands that are at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting influence on the climate or on the water reging; (b) land from which the trees described in (a) have been removed to less than 10 percent stocking, and which has not been developed for other use. (Forested tracts and islands of less than 10 acres and isolated strips of timber less than 120 feet wide are excluded.)

1. Commercial forest land - Forest land producing or capable of producing usuable crops of industrial wood.

   a. Commercial operable - Commercial forest land presently economically available within 20 years and which has not been withdrawn from use.

   b. Commercial inoperable - Commercial forest lands presently economically unavailable within 20 years and not withdrawn for specified purposes.

   c. Commercial reserved - Commercial forest land withdrawn from timber utilization through statute, ordinance or administrative order. (Classed as noncommercial productive reserved by the Forest Survey.)

2. Noncommercial forest land - Forest land incapable of producing usuable industrial wood because of adverse site conditions and not withdrawn for specified purposes.

3. Noncommercial reserved forest land - Noncommercial forest land withdrawn for specified purposes through statute, ordinance or administrative order.

Nonforest land.--Includes land which has never supported forest growth; land from which the forest has been removed to less than 10 percent stocking and has been developed for other use, such as agricultural, residential, or industrial; all land in thickly populated urban and suburban areas; house sites; trade and manufacturing sites; lighthouse reserves; and water classified by the Bureau of the Census as land, i.e, less than 40 acres in size. Glaciers, ice fields, marshland above mean high tide, permanent brush fields, muskegs less than 10 percent stocked to trees of any size and barren mountain tops are examples of lands which have never supported forest growth.

Forest Types

Commercial forest types

Forest types are classified on the basis of the predominant species or species group that accounts for the major portion of the stand in terms of net board-foot volume for sawtimber, cubic volume for poles and number of trees for seedling-sapling stands.

Sitka spruce--Afognak Island only, pure spruce stands account for the entire commercial volume present.

Hemlock-Sitka spruce--In any mixture, outside of Afognak Island.

Birch--A stand in which 50 percent or more of the gross timber volume is birch.

Western hardwoods--Stands in which 50 percent or more of the gross timber volume is composed of coastal-type hardwoods, characterized by black cottonwood and red alder with lesser mixture of Sitka spruce and western hemlock.

Noncommercial forest types

Black spruce--Short, slow growing, open to dense stands of black spruce on cold, wet, poorly drained sites on the Kenai working circle.

Scrub--An open stand of stunted, limby, defective trees of no present or prospective value. Contains less than 8,000 net board feet per acre (International 1/4-inch scale), except on the Kenai working cirle where 1,500 net board feet per acre was used as the minimum for a commercial stand.

Subalpine--Stands at the upper limits of tree growth, unmerchantable because of poor form and small size of trees. Characteristically these stands now have or will produce less than 8,000 board feet per acre, except on the Kenai working circle where these stands have less than 1,500 net board feet.

Class of Timber

Sawtimber trees--Live trees of commercial species at least 11.0 inches d.b.h. and 25 percent sound for softwoods (on the Kenai working circle a minimum diameter of 9.0 inches d.b.h. was used) and 11.0 inches d.b.h. and 50 percent sound for hardwoods, and containing at least one merchantable sawlog. A merchantable hardwood sawlog is not less than 8 feet on the Kenai working circle and 12 feet on the Cordova working circle. For softwoods the minimum log length is 12 feet.

The minimum top diameter is 8 inches d.i.b. for hardwoods and 6 inches d.i.b. for softwoods. Hardwood logs must be 50 percent sound and softwoods 33-1/3 percent. Merchantable tree height was based on the number of 16-foot logs from a stump height equal to the d.b.h. measurement, but with a fixed minimum height of 2 feet and a maximum of 4-1/2 feet. The merchantable top diameter is 40 percent of d.b.h. but not less than 6 inches i.b. for softwoods and 8 inches i.b. for hardwoods.

Poletimber trees--Live trees of commercial species from 5.0 to 10.9 inches d.b.h. on the Cordova working circle. They must contain at least one merchantable 16-foot length and be of sufficiently good form and condition to indicate that they will eventually grow into a merchantable sawtimber tree. On the Kenai working circle, trees 5.0 to 8.9 inches d.b.h. for softwoods and 5.0 to 10.9 inches d.b.h. for hardwoods not included.

Sapling trees--Live trees of commercial species 1.0 to 4.9 inches d.b.h.,of sufficiently good form and condition to indicate that they will grow into a merchantable sawtimber tree.

Cull trees--Live trees 5.0 inches d.b.h. and over that do not qualify as sawtimber or poletimber trees due to poor form, limbiness, rot or other defect.

1. Rotten cull trees contain excessive decay.

2. Sound cull trees have excessive crook, sweep, or large limbs.

Salvable dead trees--Standing dead sawtimber-size trees containing at least one merchantable sawlog and containing at least 50 percent of the tree gross board foot volume in sound material.

Stand-size Class

Sawtimber stands.--On both the Kenai and Cordova working circles, sawtimber stands with a minimum net volume of 8,000 board feet per acre (International 1/4-inch rule) were classified as commercial. However, on the Kenai working circle a further classification was made to include those stands with 1,500 to 8,000 board feet. Young-growth sawtimber stands required a potential of producing 8,000 board feet per acre.

Old-growth--Stands in which the minimum net volume for softwood types is 8,000 board feet per acre in merchantable trees 11.0 inches and larger (except Kenai which is 9.0 inches.) For hardwood sawtimber stands the minimum net volume is 4,000 board feet per acre in merchantable trees 11.0 inches and larger. The majority of the volume is in sawtimber trees more than 150 years of age.

Old growth--(Kenai Only) Stands in which the net volume for softwood types is from 1,500 to 8,000 board feet per acre in merchantable trees 9.0 inches and larger. For hardwood sawtimber stands the net volume is from 1,500 to 4,000 board feet per acre in trees 11.0 inches and larger. The majority of the volume is in sawtimber trees more than 150 years of age.

Young-growth--Stands in which the potential minimum for softwood types is 8,000 board feet per acre in merchantable trees 11.0 inches and larger (except Kenai which is 9.0 inches.) For hardwood sawtimber stands the potential minimum net volume is 4,000 board feet per acre in merchantable trees less than 150 years of age.

Poletimber--Stands failing to meet the sawtimber stand specification, but at least 10 percent stocked with poletimber and larger trees, and with at least half the minimum stocking in poletimber trees.

Seedling and Sapling--Stands not qualifying as either sawtimber or poletimber, but having at least 10 percent stocking of trees of commercial species and with at least half the minimum stocking in seedling and saplings.

Nonstocked and other areas--Commercial forest land not qualifying for any other class.

Volume Estimates

Sawtimber volume--Net volume in board feet of that portion of live sawtimber trees between the stump and the upper limit of merchantability for sawlogs. Volume deductions were made for defect and breakage. Cull factors for hemlock, spruce, and cedar were obtained from Station Paper No. 6, Alaska Forest Research Center. Cull for other species and breakage were cruiser's estimates.

Cubic-foot volume

Growing stock--Net volume in cubic feet of live merchantable sawtimber trees and live poletimber trees of commercial species from stump to a minimum 4.0-inch top (of central stem) inside bark.

All timber volume--Net volume in cubic feet of live poletimber trees, live and salvable dead sawtimber trees and cull trees of commercial species from stump to a minimum 4.0-inch top inside bark.

SPECIES TALLIED [1/]

The following commercial tree species were tallied in the Chugach National Forest. Other tree species of minor importance may occur in this area, but unless they were tallied on the field plots they are not included in the following list.

Softwoods:	
Sitka spruce	*Picea sitchensis*
White spruce	*Picea glauca*
Western hemlock	*Tsuga heterophylla*
Mountain hemlock	*Tsuga mertensiana*
Hardwoods:	
Paper birch	*Betula papyrifera*
Cottonwood	*Populus* spp.

1/ Little, Elbert L., Jr. Check list of native and naturalized trees of the United States (including Alaska). U. S. Dept. Agriculture, Agricultural Handbook 41, 472 pp. 1953.

OPERABILITY

The term operability as used by Forest Survey is defined as those characteristics of a forest stand that permit harvesting of timber which will result in a fair profit to a prudent logger of average efficiency.

Some of the more important items which govern the probability of a fair return to the timber operator are quantity, quality, location of timber stands and transportation systems. Since market conditions, logging costs and logging technology are variable and subject to change, these stands were classified on a 20 year projection.

In classifying operability on aerial photographs the following criteria was used to aid the photo interpreter. The guides, while rather general in scope, do give an estimate of the operable volume of timber. No sampling error is reported for this volume.

Operability Criteria

The cost of logs appraised to the mill can not exceed $66.00 per thousand board feet. This is based on a 20 year projection which assumes the following:

a. The present pond log value is $37.00 per thousand board feet. With an expansion in the economy there should be a 3% increase per year (compounded annually) which results in a 20 year projection of $66.00 per thousand board feet.

b. Processing mills will become situated at Seward, Afognak Island, Cordova and Whittier.

c. Standard technology will prevail, any advances will be handled under our assumption of the 3% increase per year. (This 3% is based upon an increase in productivity and a rise in the real value of the end product. See "Timber Trends in the United States," Forest Resource Report No. 17, page 8.)

d. The area east of the Copper River was judged to be inoperable because of lack of a potential transportation system. The planned road system was cancelled by the Bureau of Public Roads shortly before the analysis.

GUIDES TO OPERABILITY

The following are guides which will help classify an area without a full detailed photo appraisal.

1. Minimum operable volume per acre is 16 M per acre net water scale.

2. If tow is required, logs must be yarded in or hauled to protected water.

3. The criteria in the following table must be adhered to.

Logging Method	Maximum Yarding Reach (feet)			Notes
	Gentle slope	50% slope	100% slope	
Small A-frame	1200	1100	850	Minimum 1 MM in show
Skidder	2500	2250	1750	Minimum 8 MM " "
Slackline	1800	1600	1250	Minimum 8 MM " "
High-lead tree	1200	1100	850	Minimum 500 M to tree
Portable spar	900	800	650	Minimum 300 M to spar
Wyssen	None	3600	2800	30% minimum slope, max. of 1 int. support
Trakloader	400	275	200	Minimum 40 M
Cable swing	1200	1100	850	Cold deck min. 350 M each, No double swing
Tractor swing	4000	None	None	15% maximum grade

4. Average cost logging road - $22,000 per mile
   Easy construction 12,000 " "
   Difficult construction 45,000 " "

WORKING GROUP

To aid in multiple use planning a working group concept has been introduced in this report. The Multiple Use Zone Atlases furnished the basis for classifying land and the associated volume of timber.

The blocks (districts) were classified into one of three general working groups. These broad groups and an operability classification aid in computing annual allowable cut and also providing the basis for reporting inventory area and volume for the Periodic Timber Management Planning report (form 2400-26.)

Three groups included:

Working Group I
- a. General Forest Zone
- b. Prime Habitat Zone
- c. High Country Zone

Working Group II
- a. Travel Influence Zone
- b. Water Influence Zone
- c. Occupancy (Recreational) Zone

Working Group III
- a. Special Zone (Wild area)

For the Periodic Timber Management Planning report the above categories are combined with the operability classifications. Thus all area and volume is separated on the basis of regulation of cut.

No reserved areas occur on the Chugach National Forest.

Unregulated areas and volume are not currently regulated. The volumes do not contribute to annual allowable cut. They include:

- a. Working Group III, operable
- b. Working Group I, inoperable
- c. Working Group II, inoperable
- d. Working Group III, inoperable

Modified area and volume have a cutting rate that is different from that planned for the main regulated timber producing area. Included here is:

- a. Working Group II, operable

Non-modified area and volume is the remaining commercial forest land and its volume. This is the main or principal timber management area. It is:

- a. Working Group I, operable.

Sample Design

The design used on the three sampling units of the Chugach National Forest was described by Bickford.[1/] The Kenai working circle, Afognak block, and the Prince William Sound area (Whittier and Copper River blocks) were each treated independently.

The point sampling technique using 100 percent aerial photo coverage (excluding several icefield areas) was used to obtain area statistics. A grid overlay of four sample points per photo was systematically located on effective areas of each 1:15,840 aerial photo, except on the Prince William Sound area, where two sample points per photo were used. Each photo plot was then classified as either forest or nonforest. Forest plots were further classified according to commerciability, accessibility, local type, stand-size class, stocking and site on the basis of 10-acre minimum area.

A portion of the photo plots classified as commercial forest land was randomly selected for field examination. At the field locations, survey crews collected such data as specie, diameter, merchantable height, defect, mortality, stand-size class, forest type, etc. Three plots, each one-fifth acre in size, at 2-chain intervals were measured at each field location. The field data were used to adjust the photo classification data for all of the plots in the survey unit. The proportion of the various strata as determined by the photo plots were adjusted by the ground sample. The corrected proportions were then applied to the area of the unit.

The collected data were recorded in numerical code and sent to the Data Processing Unit at the Pacific Southwest Forest and Range Experiment Station. Data were compiled by IBM machines and 1620 computer following the general procedure contained in the "Plan for Compilation of the Alaska Forest Survey by the IBM Method." Briefly, the procedure is as follows: All of the data recorded for each tree were punched on individual tree cards by location. These data were then processed by an IBM 1620 for an initial output of minor breaks. In successive passes through the 1620, these data were summarized in tables with their associated sampling errors.

Output is in terms of acres, net volume in Scribner, International 1/4-inch rule, cubic-foot volume and number of trees. Gross volume is adjusted to net using Kimmey defect factors as noted on the individual trees and by applying average breakage factors as noted for the plot locations.

1/ Bickford, C. Allen. The sampling design used in the forest survey of the Northeast. Journal of Forestry, Vol. 50, No. 4, pp. 290-293 1952.

The number of ground plots necessary was computed from the following formula:

$$n = \frac{a\ (aA + b\sqrt{AB}\ )}{AS^2}$$

The number of photo points necessary was determined by using the following formula:

$$m = \frac{nb^2}{nS^2 - a^2}$$

After the initial field work in the Prince William Sound area in 1960, a preliminary statistical analysis indicated a very high area sampling error. Most of this error resulted from the small sample size, relatively large area, and high proportion of area changing to commercial forest land from non-commercial forest land. Therefore, an additional sample of 112 plots was drawn from the noncommercial forest land area. These plots were checked by a combination of photo interpretation, air check and ground plots. The resulting statistics were more accurate with a resulting lower sampling error.

The variance of the estimated area of a ground class is computed:

$$S_{A_j}^2 = \left(\frac{P_i^2\ P_{ij}\ (1-P_{ij})}{n_i} + \frac{(P_i\ P_{ij}^2) - (\sum P_i\ P_{ij})^2}{m} \right) A_g^2$$

The variance of the total volume is computed:

$$S_{V_T}^2 = \left(\frac{P_i^2\ S_i^2}{n_i} + \frac{\sum P_i\ (\bar{y}_i - \bar{y}_w)^2}{m} \right) A_g^2$$

The square root of variance of area or volume equals sampling error.

Terms defined

A = Cost of a ground plot

a = $\sum P_i S_i$

A_g = Total unit area

B = Cost of a photo point

b^2 = $\sum P_i (\bar{y} - \bar{y}_w)^2$

m = Total number of photo points

n = Total number of ground plots

n_i = Number of ground plots in i^{th} photo stratum

P_i = Proportion of photo points in i^{th} stratum

P_{ij} = Proportion of ground plots of i^{th} photo stratum that are in the j^{th} ground class.

$S^2_{A_j}$ = Variance of the estimated area of j^{th} ground class

s_i = Standard deviation of volume in i^{th} photo stratum (in bd. ft.)

S^2_V = Variance of the total unit volume

V_T = Total working circle volume

$\bar{y}_i$ = Average volume in the i^{th} stratum

$\bar{y}_w$ = Weighted average volume for the unit

Sample locations examined by timber management unit,

Chugach National Forest, 1960-62

Working Circle and Management Unit	Photo Plots	Ground Locations		
		Total	CFL	NCFL & NF
Cordova Working Circle:				
Afognak Block	2,149	61	55	6
Whittier Block	2,821	80	22	58
Copper River Block	3,303	101	52	49
Kenai Working Circle	5,826	92	70	22
Total Chugach NF	14,099	334	199	135

Reliability of the Estimate

The forest-area and timber-volume data presented in this report are based on a carefully designed sample of forest conditions on the Chugach National Forest. A measure of reliability of these estimates is given by the statistical "sampling error." Each estimate in this report has a sampling error, although not all of them have been computed.

Briefly, here is the way sampling error indicates reliability. The total commercial forest area on the Chugach of 754,600 acres has an associated sampling error of 8.2 percent (± 62,200 acres). This means that if we were to repeat the survey, the odds are two to one that the new acreage would fall between 692,400 and 816,800 acres (754,600 ± 62,200). Similarly, the odds are 19 to 1 that it would be within ± 124,400 acres (2 X 62,200).

Sampling error increases with the minor breakdowns of area or volume. This is caused, in part, by the correspondingly smaller sample taken in these strata.

Even the computed sampling error is not a complete measure of reliability; there are other sources of error that are not attributed to sampling. These are human mistakes in judgment, measurement, recording or computation. There is no practical method of measuring how often this type of error occurs. These errors are kept to a minimum by careful training, frequent inspection, and application of the most reliable survey methods for condition in the region.

Accuracy of the Timber Volume Estimates
All Ownerships

Commercial Forest	Afognak		Whittier & C.R.		Kenai	
	Volume MBF Scribner	Percent S.E.	Volume MBF Scribner	Percent S.E.	Volume MBF Scribner	Percent S.E.
Accessible	5,245,783	7.3	6,332,698	10.4	1,583,085	17.8
Inaccessible	30,810	100.0	1,215,092	28.6	0	0
Total	5,276,593	7.1	7,547,790	9.5	1,583,085	17.8

The probabilities are two out of three that the actual sawtimber board-foot volume is within ± 9.53 percent of the estimated total volume for the Chugach National Forest. (14,407,468 ± 1,373,032 MBF).

Accuracy of the Forest-area Estimates
(Acres---All Ownerships)

Forest-land Class	Afognak		Whittier & Copper River		Kenai	
	Area	S.E. Percent	Area	Percent	Area	Percent
Commercial Accessible	226,293	7.6	264,154	10.6	189,593	7.0
Commercial Inaccessible	3,742	100.0	70,781	26.2	0	0
Total Commercial	230,035	7.3	334,935	9.6	189,593	7.0

The probabilities are two out of three that the actual commercial forest-land area is within ± 8.2 percent of the estimated total CFL area on the Chugach National Forest (754,600 ± 62,200).

Coefficient of Variation

The coefficients of variation as determined from the field plots examined on commercial forest land are listed below. This was calculated on the basis of woods-gross, board-foot volume (Scribner) of live merchantable sawtimber trees.

Sawtimber	Afognak		Whittier & Copper River		Kenai			
					1,500-7,999		8,000+	
	C.V.	No. Plots	C.V.	No. Plots	C.V.	No. Plots	C.V.	No. Plots
Young growth	63.8	17	82.2	7	32.5	3	51.2	3
Old growth	39.1	34	51.9	63	45.9	13	36.6	41
Total	47.9	51	57.8	70	45.9	16	37.1	44

The coefficient of variation, on the Kenai, for all 60 sawtimber plots combined (1,500-7,999 and 8,000+) was 55.4 percent.

Table of Scribner to International 1/4-Inch Ratios

Species	10" DBH Group	Ratio
Western hemlock, mountain hemlock, and Sitka spruce	11.0" to 20.9"	1.16
	21.0" to 30.9"	1.09
	31.0" to 40.9"	1.05
	41.0" and larger	1.03
Alaska-cedar	all diameters	1.14
Western red cedar	all diameters	1.16
Lodgepole pine	all diameters	1.16
Hardwoods	all diameters	1.15

Average Form Class

Species	Form Class 16-foot log	Form Class 32-foot log
Western hemlock	78	73
Mountain hemlock	78	73
Sitka spruce	78	73
Cottonwood	78	-
Birch	78	-

Cull

In reducing the forest inventory gross volume to net volume, two factors are involved. One of these is breakage, which is a cruiser's estimate of the loss of volume expected in felling. It is based upon the terrain, species, size, and general thriftiness of the stands. The second and more important volume loss is cull, both sound and rotten.

Sound cull is loss of volume from such things as shake, crook, sweep, frost cracks, etc. Unless extreme, crook and sweep do not contribute to loss of cubic-foot volume but only of board-foot volume. Shake will cause a loss of both cubic- and board-foot volume.

Rotten cull is caused by two general types of decay: ("brown rot" and "white rot"). In brown rot, the causal fungi attack primarily the cellulose fibers; in white rot, the lignin content of the wood is attacked. Two general stages of decay are recognized. They are the early, or incipient stage of decay and the late, or typical stage. Cull deductions were made for all stages of decay.

The amount of cull in individual trees not only varies between tree species, but also within a given diameter class of a single species. Much of this variation can be detected in standing trees by the recognition of indicators on the individual trees. The following were found to be reliable indicators of rotten cull in spruce and hemlock.

1. Conks--of Fomes, Trametes, Armillaria, Polyporus or Phoiota
2. Swollen knots--caused by Fomes pini.
3. Scars--fire or mechanical injury exposing the heartwood in the main bole below the merchantable top.
4. Frost cracks--in the main bole.
5. Rotten stubs--(old dead tops or twin boles) protruding from the lower main bole.
6. Rotten burls or cankers--from any cause and on the main bole.

Western redcedar cull indicators are:

1. Sucker limbs--of bayonet type.
2. Scars--any cause, when on the main bole.
3. Dead side or dead strip--where part of the cambium is killed.
4. Rotten burls--on the main bole.

The following injuries or characteristics were found not to be indicators of cull. They are:

1. Dead, broken, or spike tops when not extending into the merchantable bole.

2. Large dead branches.

3. Scaly bark.

4. Rough boles.

5. Forked tops.

6. Black knots on hemlock.

7. Sound burls.

The following table expresses the percent of sound volume for individual trees by species and diameter classes. A sound tree has no cull indicators. A tree with a cull indicator on either the lower bole (the first 32 feet above the stump) or upper bole (that portion of the tree above the first 32-foot log) has a condition class of 1. A tree with indicators on both the lower and upper boles has a condition class of 2. Note that a tree with less than 25 percent sound volume is cull.

KIMMEY'S BOARD FOOT MERCHANTABILITY FACTORS

DBH Class	HEMLOCK			SPRUCE			CEDAR		
	Condition Classes								
	Sound	1	2	Sound	1	2	Sound	1	2
12	95	75	65	99	68		56	51	
14	95	75	64	↑	68		56	50	
16	95	75	63		68		55	50	
18	95	74	62		69		55	50	
20	95	74	60		69		54	49	
22	94	73	58		69		54	48	
24	93	72	56		69		53	46	
26	93	71	54		70		52	44	
28	92	70	52		70		51	42	
30	91	68	49	↓	70		49	40	
32	89	67	46	99	71		48	37	
34	88	66	43	98	71		47	33	
36	86	64	41	↑	72		45	30	
38	85	63	38		72	26	44	26	
40	84	61	35		73	28	43		
42	82	60	32		74	29	42		
44	80	58	29		75	31	41		
46	79	57	27	↓	75	33	40		
48	77	55		98	76	34	40		
50	75	54		97	77	35	39		
52	74	53		↑	78	37	39		
54	72	52			79	38	39		
56	71	51			80	39	39		
58	69	51			80	40			
60	68	50			81	41			
62	67	49			82	42			
64	65	48		↓	83	42			

GSA JUNEAU, ALASKA 68-319